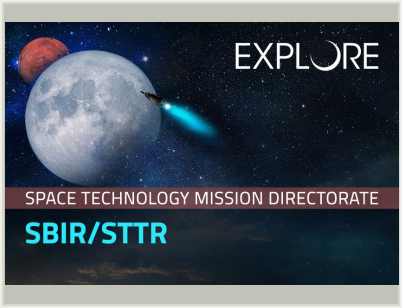
High Heat Flux Block Ablator-in-Honeycomb Heat Shield Using Ablator/Aerogel-Filled Foam, Phase II

Completed Technology Project (2015 - 2017)

Project Introduction

Ultramet and ARA Ablatives Laboratory previously developed and demonstrated foam-reinforced carbon/phenolic ablators that offer substantially increased high heat flux performance and reduced weight relative to conventional ablators. The structure consisted of an ablator-filled foam front surface backed by Ultramet's highly insulating aerogel-filled foam. Arcjet testing was performed at NASA ARC to heat flux levels exceeding 1000 W/cm2, with the results showing a significantly reduced ablation rate compared to conventional chopped fiber ablators, and ablation behavior comparable to FM5055 at just one-third the density. In 2008, NASA ARC contracted ARA to develop a new heat shield design involving integration of fully cured mid-density ablator blocks within a structural honeycomb reinforcement. The block ablator-in-honeycomb heat shield is envisioned to provide high atmospheric entry reliability due to the structural attachment integrity provided by the honeycomb lattice in the ablative material layer. In Phase I, the Ultramet-ARA team demonstrated the initial feasibility of using ablator/aerogel-filled foam within honeycomb cells through fabrication of a 16-cell panel in which foam blocks were literally pressed to shape using a die and then snug-fit into carbon/phenolic honeycomb cells. The 16-cell panel was infiltrated with ablator to a controlled depth on the front face, which simultaneously bonded the foam blocks to the honeycomb, and the remaining foam void space on the back face was filled with aerogel. In Phase II, block ablator-in-honeycomb structures will be optimized through flat and curved panel fabrication, properties testing, and high heat flux testing at NASA ARC and the Air Force LHMEL facility. This effort will leverage a current Ultramet project for NASA ARC focusing on optimization of ablator-filled foam compositions for use in the 1000-8000 W/cm2 heat flux range, which could ultimately be used in the block ablator-in-honeycomb architecture.



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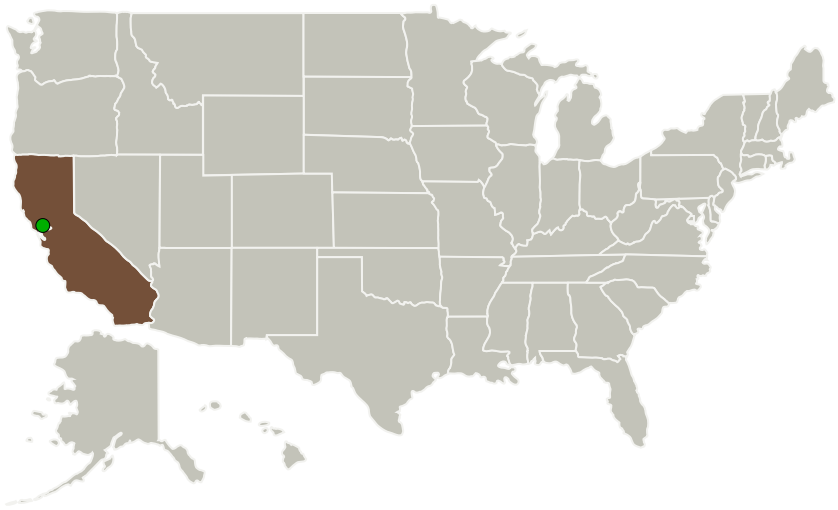
Completed Technology Project (2015 - 2017)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ultramet	Lead Organization	Industry	Pacoima, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ultramet

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

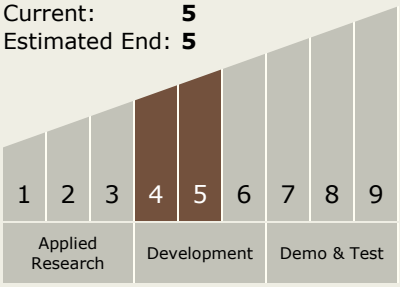
Carlos Torrez

Principal Investigator:

Brian E Williams

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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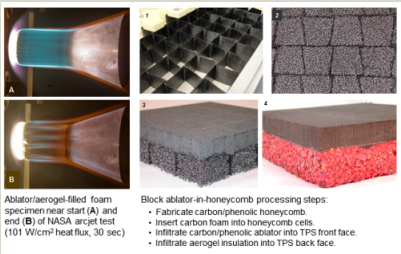
Images



Briefing Chart
High Heat Flux Block Ablator-in-Honeycomb Heat Shield Using Ablator/Aerogel-Filled Foam, Phase II Briefing Chart *(https://techport.nasa.gov/image/130383)*

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.1 Aeroassist and Atmospheric Entry
    - TX09.1.1 Thermal Protection Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System